AMENDMENTS TO THE DRAWINGS

The attached sheets of drawings include new Figures 9a, 9b, 10a, 10b, 11a, 11b and 12a through 12d.

Attachment: Four (4) additional drawing sheets

REMARKS

This paper is responsive to the Final Office Action dated May 15, 2008 ("Final Office Action"). Claims 1–28 are pending in this Patent Application. Of these, claims 3, 5–8, 10, 11, 14, 15, 17, 20, 21 and 23–28 are withdrawn from consideration, and claims 1, 2, 4, 9, 12, 13, 16, 18, 19 and 22 were considered on the merits. Claims 1, 2, 4, 9, 12, 13, 16, 18, 19 and 22 were rejected.

In this Response, the specification and drawings have been amended to insert material previously incorporated by reference. Claim 1 has been amended to clarify the claimed subject matter. Claim 24 has been amended to remove a typographical error. New dependent claims 29–35 have been added to point out further aspects of the invention. No new matter has been introduced. In view of the foregoing amendments and following remarks, Applicants respectfully request withdrawal of all rejections.

Telephone interview of November 7, 2008

Applicants thank Examiner Dr. Yelena Gakh for kindly granting a telephone interview on November 7, 2008 with one of the inventors on this patent application, Dr. Mark Stockman, and Applicants' agent, Andrea Pacelli. During the interview the outstanding rejections in the Final Office Action were discussed. The discussion concerned claim 1, both in its original form and with respect to proposed amendments substantially identical to those submitted herein. An agreement was reached as to the patentability of the amended claim 1 over the prior art cited in the Final Office Action.

Amendments to the specification and drawings under 37 C.F.R. 1.57(f)

The specification and drawings have been amended to insert material previously incorporated by reference from U.S. Provisional Patent Application No. 60/437,760 ("the Provisional"). The inserted textual material is virtually identical to that in the Provisional, except for inconsequential changes in tone, style and formatting, and the addition of an introductory heading and paragraph to link the material to the rest of the specification. The new drawings are virtually identical to those in the Provisional, except for a renumbering of the figures. Accordingly, the amendment contains no new matter.

Claim rejections – 35 U.S.C. § 112

Claims 1, 2, 4, 9, 12, 13, 16, 18, 19 and 22 were rejected under 35 U.S.C. § 112, second paragraph, as indefinite. Applicants respectfully request withdrawal of the rejection for at least the reasons stated below.

The Final Office Action indicated on page 2 that the expression "transition of the at least one object" is indefinite "since 'transition' of the structural element can be considered as moving the structural element in the space." The Examiner also suggested to amend the claim language to clarify whether "the Applicants meant to recite energy transition that the object undergoes." *Id.* In response, claim 1 has been amended to clarify that "the application of energy . . . results in the energy transition of the at least one object." Since the amendment has only the purpose of clarification, there is no change of claim scope.

The Final Office Action further indicated on page 2 that the expression "the application of the energy source to the active medium" does not seem to be technically correct. The Examiner suggested amending the expression by reciting "application of energy from the energy source to the active medium." *Id.* In response, claim 1 has been amended to adopt the Examiner's suggested expression. Since the amendment has only the purpose of clarification, there is no change of claim scope.

Finally, the Final Office Action indicated on pages 2–3 that the clause "wherein the stimulated emission causes the buildup of a macroscopic number of surface plasmons in the at least one surface plasmon mode" is a functional language of the claim, which does not further limit the structure of the apparatus recited in the claim. Applicants do not believe that the above comment is ground for a rejection under 35 U.S.C. § 112, second paragraph. However, to expedite prosecution, claim 1 has been amended to clarify that "the energy source is adapted to provide a power sufficient to induce population inversion and stimulated emission, thereby causing the buildup of a macroscopic number of surface plasmons in the at least one surface plasmon mode." Applicants believe that the addition of such language, while not changing the scope of the claim in any way, highlights the structural relation between the elements of the claimed apparatus.

Claim rejections – 35 U.S.C. § 102

Claims 1, 2, 4, 9, 12, 13, 16, 18, 19 and 22 were rejected under 35 U.S.C. § 102(a) over O. Kulakovich et al., "Enhanced Luminescence of CdSe Quantum Dots on Gold Colloids," *Nano Letters* 2(12):1449 (hereinafter "Kulakovich"). Applicants respectfully traverse the rejection. Anticipation under 35 U.S.C. § 102 requires that each and every element as set forth in the claim be found in a single prior art reference. MPEP § 2131. Claim 1, as currently amended, includes the limitation that "the energy source is adapted to provide a power sufficient to induce population inversion and stimulated emission, thereby causing the buildup of a macroscopic number of surface plasmons in the at least one surface plasmon mode." Applicants submit that Kulakovich does not teach, or even fairly suggest, this limitation.

The teachings of Kulakovich may be summarized as follows. The reference generally discusses the properties of a system comprising a monolayer of gold nanoparticles deposited on a glass substrate, a multilayer polymer film acting as an inert spacer, and a film of CdSe/ZnS quantum dots. Kulakovich at 1450, left column. The quantum dots were excited by 550 nm light and the photoluminescence (PL) signal was plotted against the spacer thickness. Kulakovich at 1451. Kulakovich reports a peak in the photoluminescence (PL) signal at a spacer thickness around 11 nm. *Id.* Kulakovich explains the decrease in the PL signal at very small values of the spacer thickness by resonant energy transfer (RET) between the quantum dots and the metallic surface. Kulakovich at 1451, right column.

Claim 1 has been amended to clarify the claimed subject matter, and now includes the limitation that "the energy source is adapted to provide a power sufficient to induce population inversion and stimulated emission, thereby causing the buildup of a macroscopic number of surface plasmons in the at least one surface plasmon mode." The amendment is fully supported by the specification as amended, therefore no new matter has been added. In particular, the specification as amended discusses the population densities $\rho_0(\mathbf{r})$ and $\rho_1(\mathbf{r})$ in the ground and excited states, and the population inversion $\rho_1 - \rho_0$. *See* this paper at 9–10. The specification as amended also teaches that quantum amplification and generation of surface plasmons exists if the dimensionless gain of the *n*-th eigenmode,

indicated with the symbol α_n, is greater than zero. *See* this paper at 10. In turn, the quantity p_n, which depends on the population inversion, directly enters the expression for the dimensionless gain α_n through the Einstein coefficient A_n. *Id.* Applicants submit that, as in the known laser devices, the establishment of population inversion and stimulated emission requires a minimum power to be provided by the energy source in the apparatus as claimed.

The Final Office Action indicated on page 3 that Kulakovich anticipates the subject matter of claim 1 because the gold nanoparticles are "a resonant medium having at least one surface plasmon mode therein," and the CdSe quantum dots are "an active medium." However Kulakovich does not even report the observation of stimulated emission, and certainly does not teach that "the energy source is adapted to provide a power sufficient to induce population inversion and stimulated emission, thereby causing the buildup of a macroscopic number of surface plasmons in the at least one surface plasmon mode." Kulakovich does not discuss the buildup of a macroscopic number of surface plasmons, and does not teach under which conditions such buildup may occur.

For at least the above reasons, Applicants respectfully submit that claim 1 is patentable over Kulakovich. Claims 2, 4, 9, 12, 13, 16, 18, 19 and 22 depend from claim 1 and are allowable for at least the same reasons.

Claims 1, 2, 9, 12, 13, 16, 18, 19 and 22 were rejected under 35 U.S.C. § 102(a) over K. T. Shimizu et al., "Surface-Enhanced Emission from Single Semiconductor Nanocrystals," *Phys. Rev. Lett.* 89(11):117401 (hereinafter "Shimizu"). Applicants respectfully traverse the rejection on the ground that Shimizu does not teach, or even fairly suggest, the limitation that "the energy source is adapted to provide a power sufficient to induce population inversion and stimulated emission, thereby causing the buildup of a macroscopic number of surface plasmons in the at least one surface plasmon mode."

The teachings of Shimizu may be summarized as follows. The reference generally discusses the properties of a system comprising a rough gold substrate formed on a silicon wafer, and CdSe/ZnS nanocrystals deposited thereon. Shimizu at 117401-1. The sample was excited by 514 nm light and fluorescence from the nanocrystals was measured. *Id.* Shimizu attributes an observed enhanced fluorescence to resonance between the dipole

frequency of the nanocrystals and the metal surface plasmon. Shimizu at 117401-3. Shimizu also discusses the role of nonradiative energy transfer from the excited dipole to the metal. *Id.*

The Office Action indicated on page 3 that Shimizu anticipates the subject matter of claim 1 because the rough gold film is "a resonant medium having at least one surface plasmon mode therein," and the nanocrystals are "an active medium." However Shimizu, like Kulakovich, does not even report the observation of stimulated emission, and certainly does not teach that "the energy source is adapted to provide a power sufficient to induce population inversion and stimulated emission, thereby causing the buildup of a macroscopic number of surface plasmons in the at least one surface plasmon mode." Shimizu does not discusses the buildup of a macroscopic number of surface plasmons, and does not teach under which conditions such buildup may occur.

For at least the above reasons, Applicants respectfully submit that claim 1 is patentable over Shimizu. Claims 2, 9, 12, 13, 16, 18, 19 and 22 depend from claim 1 and are allowable for at least the same reasons.

New claims

New dependent claims 29–35 have been added to point out further aspects of the invention. All new claims are fully supported by the specification as amended, and no new matter has been added.

Other amendments to the claims

Claim 1 has been amended to change the expression "dipole oscillator strength" into "transition strength" to clarify the scope of the invention as claimed. The amendment is fully supported by the specification as amended. *See, e.g.*, this paper at 11–12.

Claim 24, previously withdrawn, has been amended to remove a typographical error (extraneous letter "s").

Conclusions

In view of the foregoing amendments and remarks, Applicants respectfully submit that the present application is in condition for allowance. This submission is accompanied by payment of a $1,110 fee for a three-month extension of time, an $810 fee for a request for continued examination, and a $364 fee ($52 × 7) for dependent claims 29–35. The Commissioner is hereby authorized to charge any other fees, or refund overpayments, to Deposit Account No. 11-0980.

Respectfully submitted,
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